A novel tool for conformal magnetic field mapping using magnetoresistive sensors on modular, flexible and stretchable substrates

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The progresses achieved recently in integration of functional magnetoelectronic materials on flexible substrates (namely polyamide) and stretchable inspired a realm of new devices and applications. Although device performance is still degraded with the non-rigidity of the substrates, the impact on a flexible/bendable sensor solution maintains these as hot topics, in particular for medical applications. By using more than one individual sensor, the additional available information allows imaging of larger areas to determine the location and landscaping of a magnetically tagged surface.

The candidate will prepare a process run-sheet with the steps needed for microfabrication of integrated sensors, adjusted to the particular materials used as substrates. The process run sheet will include test structures and validation points for microfabrication process control, towards a zero defect, 100% yield process. Several mask levels will be designed and tested, using a process compatible with INESC-MN and also INL's Clean Room microprocessing tools on 150mm diameter wafers. The work will profit from the recent progress achieved between INESC-MN and INL in MR sensor integration into flexible substrates (polyamide). Spinvalves (SV) with magnetoresistance values MR~9% and magnetic tunnel junction (TMR) sensors based on CoFeB/MgO/CoFeB stacks with MR~ 150%, and sensitivities better than ~5%/Oe will be used.

The impact of substrate rigidity in sensor's performance will be assessed through evaluation of the sensor properties under mechanical bending/stretching conditions.

Magnetic field sensors microfabricated on flexible and stretchable substrates allow the device to softly bend to conform to an arbitrary topography. The work will result on the optimization of modular arrays of sensors patterned over large areas providing a network of spatially resolved imaging pixels. Integrated electronics will include CMOS multiplexing.

Profile sought: preference, but not limited, to students with a background in Physics and Electrical Engineering with an interest in Devices, and Micro and Nanofabrication.